Spectral-time transformation of the femtosecond laser radiation under filamentation in gaseous media

Graduate work of the 6 year student of the

Chamber of General Physics and Wave Process

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Annotation

In this graduate work an experimental research on spectral-time transformation of the collimated femtosecond laser radiation under filamentation in gaseous media (air, nitrogen, argon) is presented. Also is studied spectra broadening due to the filamentation and behavior of the short wavelength wing along filament from the very beginning of its formation (1.5 meters along laboratory track) to the end of its existence (about 6-7 meters). Besides an influence of the aperture diameter is clearly shown – one can easily see that spectrum broadening is much more effective with 200 mkm aperture diameter than with 3 mm aperture. Moreover comparison of the spectra broadening for different gases is also given. Best results were achieved in argon under pressure 0.8-0.9 from atmospheric.

In the second part of this work spectral “soliton” formation under filamentation in molecular gases is studied in dependence from the distance along propagation, laser pulse chirp, and aperture diameter. It was shown that “soliton” is shifted to the IR part of the spectrum with distance increasing. The magnitude of the shear depends on the spectral phase chirp of the initial radiation. Zero chirp corresponds to the maximum shear of the “soliton”. Spectra measurements in different areas near central axis also we carried out and one can see that “soliton” propagates mainly in the central area of filament. Besides simultaneously with spectral component that correspond to the “soliton” one can see other component symmetrical towards carrying wavelength. This feature might be explained through four-wave processes. Duration of the “soliton” was estimated by SPIDER technique.

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